

REMARKS

Claims 40-57, 64-68, 70, 71, and 74-86 are pending in the above-referenced application. Claims 40-57, 64-68, 70, 71, and 74-86 are rejected. In particular and in accordance with the delineated sections therein, the Office Action has:

1. Rejected claims 40-55, 57, 65-68, 71, and 74-86 under 35 USC § 112 2nd paragraph as being indefinite. In particular, the Office Action alleges that in claims 51, 52, 55, 56, 64 and 70, the recitation of “emitter layer...to emit electrons” is indefinite;

2. Rejected claims 55, 56, and 70 under 35 USC § 102(b) as being anticipated by Hsu (U.S. Patent No. 6,448,701); and

3. Rejected claims 64-67, 76-78, 81-83, 85 and 86 under 35 USC § 102(b) as being anticipated by Nakamoto (U.S. Patent No. 6,097,138)

Regarding Item 1, claims 51, 55, 56, 64, and 70 have been amended to avoid the ambiguity raised by the examiner. The claims now recite that it is the surface of the embedding material from which the nano-structures protrude. Claim 70 has been additionally amended to remove the objected to process limitation.

Regarding Item 2, the Office Action has alleged that claim 55 is anticipated by Hsu citing item 104, in Hsu, for the cathode, item 102 for the substrate, 106 for the embedding material, item 114 for the nano-structures, column 6, lines 7-12 of Hsu for the portions of the nano-structures protruding above the surface to emit electrons, top portion of 106 for the insulator, and item 108, in Hsu, for the gate electrode. Applicant respectfully submits that the structure recited in claim 55 is not the structure taught by Hsu. In particular, the nano-structures in Hsu are not embedded in any embedding material, as each of the figures in Hsu shows. The nano-structures in Hsu are isolated and separate from the insulator 106. For example, in FIGs. 1(a)-1(g) of Hsu, after the insulator layer 106 is deposited and after stand off layers 112 are formed, the nanofilaments are grown on the top of the exposed catalyst layer 104 disposed at the bottom of the gate aperture 110. This indicates clearly that the nanofilaments are not part of the insulator layer 106. They are independent of it. Hsu ‘701, Col. 5, line 9 to Col. 6 line 25.

Furthermore, the insulator layer 106 in Hsu, because it is not an embedding layer cannot be identified as both the insulator and the embedding material of Applicant’s invention. The insulator

and the embedding material are two distinct elements in claim 55. Thus, Hsu fails to teach the limitation “an emitter layer disposed over said cathode electrode and formed from a composition of an embedding material and one or a plurality of nano-structures embedded therein,” as recited in claim 55, and claims 51, 56, 64, and 70.

Additionally, the cited portions of Hsu fail to teach the limitation “a gate electrode having one or a plurality of apertures, wherein each aperture exposes a single nano-structure and is concentrically self-aligned with the end of the nano-structure,” as recited in claim 55. The Hsu reference instead teaches that there are a “bunch” of CNTs in each aperture. Hsu, FIG. 1(e), 1(g). With a large number of CNTs in the aperture, there is no CNT that meets the limitation that the apertures of the gate electrode are concentrically self-aligned with the end of the nano-structure. In fact, the structures of Applicant’s invention and Hsu are fundamentally different, in that Hsu has an aperture for a large bunch of CNTs, each of which is randomly located therein, and Applicant’s invention has a single aperture for each CNT which is centrally located therein. Thus, in Hsu, each CNT in the gate aperture has a different emitter-to-gate distance. This results in non-uniform emission among emitters and low emission efficiency for those emitters that are closer to the gate electrode. Applicant’s arrangement avoids these problems because each emitter has a controlled relation with the gate aperture. Therefore, Hsu fails to teach the limitation “a gate electrode having one or a plurality of apertures, wherein each aperture exposes a single nano-structure and is concentrically self-aligned with the end of the nano-structure,” as recited in claim 55 and claims 51, 56, 64, and 70.

Regarding Item 3 in which claims 64-67, 76-78, 81-83, 85, and 86 have been rejected, Applicant respectfully submits that claim 64 is not anticipated by Nakamoto. Figure 16 of Nakamoto does not show “a gate electrode disposed over the insulator and having one or a plurality of apertures, wherein each aperture exposes a single nano-structure and is concentrically self-aligned with the end of the nano-structure,” as recited in claim 64. Instead, Nakamoto shows a number of CNTs 122 in the aperture of the gate electrodes 128. Nakamoto states, in regard to FIGs. 14A and 14H, that a plurality of carbon nanotubes 136 are exposed in the aperture 155 of the conductive material layer 153 serving as the gate electrode. Nakamoto ‘138, Col. 16, lines 60-65, Col. 17, lines 6-118. This plurality of CNTs suffers from the same deficiency as those of Hsu, namely, that there are no CNTs that are centrally positioned in the gate aperture. That is, each gate aperture does not expose a single carbon nanostructure and the gate aperture is not concentrically self-aligned with the end of the nano-structure. Again, as in Hsu, Nakamoto suffers from differing

distances between the CNTs in the aperture and the gate electrode, leading to non-uniform emission and low emission efficiency for those CNTs closer to the gate electrode.

Regarding claim 81, the Office Action has alleged that Nakamoto teaches the limitation "wherein said nano-structures are individually spaced apart," recited therein. Applicant submits that Nakamoto does not teach that the nano-structures are individually spaced apart, because Nakamoto shows a plurality of nano-structures in the gate aperture. There appears to be no attempt in Nakamoto to control the placement of each of the plurality of nano-structures in aperture.

Regarding claims 65-67, 76-78, 82-83, 85, and 86, Applicant submits that these claims are allowable at least because the claims from which they depend are allowable.

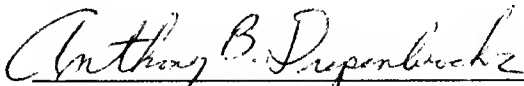
Conclusion

Claims 40-57, 64-68, 70, 71, and 74-86 are believed to satisfy all of the criteria for patentability and are in condition for allowance. An early indication of the same is therefore kindly requested.

No fees beyond the extension of time fees are believed to be due in connection with this Amendment. However, the Director is authorized to charge any additional fees that may required, or credit any overpayment, to Dechert LLP Deposit Account No. 50-2778 (**Order No. 372668-00400 (362842)**).

Respectfully submitted,

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